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## Bismarck versus Beveridge: Flat- and earnings-related unemployment insurance in an efficiency wage framework

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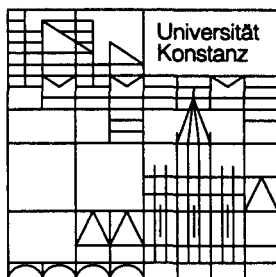
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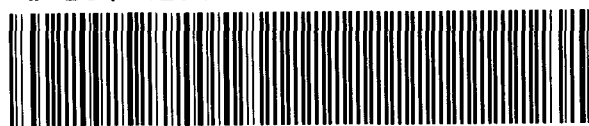
## Fakultät für Wirtschaftswissenschaften und Statistik

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**Serie I - Nr. 291**

**November 1998**

# Bismarck versus Beveridge

## Flat- and Earnings-Related Unemployment Insurance in an Efficiency Wage Framework\*

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### Abstract

A higher unemployment compensation increases the incentive to shirk in efficiency wage models. If there is a stronger dependence of unemployment benefits on current earnings, these incentives will be reduced. An unemployment insurance with earnings-related benefits is thus characterised by higher employment than one with flat-rate benefits. It is investigated under which conditions this advantage persists in the longer term when financial constraints such as an ex-post constant level of benefits, a cash limit or a balanced budget rule apply, or when firms are constrained to zero profits.

**Keywords:** balanced budget, cash limit, earnings-related benefits, efficiency wages, flat-rate benefits, long-run, unemployment insurance

**JEL-classifications:** H 24, H 25, J 32, J 41, J 65

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## 1. Introduction

The microeconomic models which are predominantly used to rationalise the existence of unemployment are search models, union-firm bargaining and efficiency wage approaches (Pissarides 1998). One of the central predictions of efficiency wage models is that an increase in unemployment compensation reduces the incentives to retain a specific job and raises the costs per efficiency unit of labour. Higher unemployment benefits thus increase the number of jobless.<sup>1</sup> In general, benefits are modelled as constant and exogenously given and as unrelated to the previous work experience or personal background of the unemployed. This has been criticised as a misrepresentation of the institutional features of unemployment insurance (UI) systems (Atkinson and Micklewright 1991). Thus, in this paper, a specific aspect of real world benefits is analysed in a shirking model of efficiency wages, namely, the impact on wage and employment outcomes of earnings-related in contrast to flat-rate unemployment benefits.

The unemployment consequences of a flat-rate in contrast to an earnings-related non-work income have not been investigated systematically in the context of imperfect labour market models. Pissarides (1998), for example, has demonstrated for trade union and job search models that a UI system with a constant replacement ratio will entail more beneficial employment consequences than one with constant benefits if a tax on labour costs is lowered. Vijlbrief and van de Wijngaert (1995) show that a fixed level of benefits induces more employment than a constant replacement rate in a monopoly union model. However, Goerke and Madsen (1998) show that this finding does not hold for bargaining models. Based on search models, Atkinson (1995) and Hey and Mavromaras (1981) investigate the impact of changes in unemployment benefits and argue that the distinction between flat-rate and earnings-related benefits is without influence on employment. However, Pissarides (1990, pp. 142f) indicates the potential advantage of earnings-related benefits for employment, without pursuing this issue further. Finally, Schluter (1997) finds no impact of different benefit systems for low tax rates and benefit levels in a search theoretic framework, although an earnings-related UI can induce higher unemployment if taxes are very high.

In the debate about social insurance systems, earnings-related and flat-rate benefits have often been associated with the names of Bismarck and Beveridge, respectively. Although an UI was not introduced in Bismarck's period as German Chancellor, the scheme finally established in 1927 was modelled along the lines of the other social security systems set up under his rule: compulsory, earnings-related contributions give (former) employees - subject to restrictions - an entitlement to earnings-related benefits. Such a system can be contrasted with the one which was set up in the UK in 1911 for some trades, and expanded following the Beveridge Report from 1942. It was based on fixed contributions and flat-rate benefits. Juxtapositioning Bismarck and Beveridge is a simplification, but captures the different philosophies underlying flat-

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<sup>1</sup> This positive relationship between the level of benefits and unemployment need not always hold in adverse selection or fair wage, multi-sector models (see Stiglitz (1986, p. 188), Agell and Lundborg (1992) or Albert and Meckl (1997)).

rate and earnings-related benefits: is unemployment compensation a means to preserve income or is it an instrument to guarantee the fulfilment of basic needs (Schmid et al. 1992, p. 75)?<sup>2</sup>

In Section 2, an overview of UI systems in OECD countries is presented, while in Section 3, a simple shirking model of efficiency wages is set up. In order to contrast the impact of flat-rate and earnings-related benefits, in Section 4, a Bismarckian system in which benefits depend on income is compared to a Beveridgean scheme based on a flat-rate compensation. In Section 4.1, first, changes in the level of benefits are investigated and, second, the structure of unemployment compensation is altered by strengthening the earnings-related element at the expense of the flat-rate component, while holding the level of benefits constant for a given wage. Subsequently, a longer term perspective will be chosen by introducing different balanced budget requirements. More specifically, in Section 4.2, the impact of a constant benefit requirement - taking into account wage changes -, that is, assuming a constant expenditure per unemployed, is analysed. A cash limit for the UI is examined in Section 4.3. In Section 4.4, the revenues of the UI system are incorporated by imposing a balanced budget constraint. Then, a very long-run perspective is adopted by endogenising the number of firms in Section 4.5. Section 5 summarises and discusses policy implications.

## 2. Unemployment Insurance Systems in OECD Countries

Let unemployment compensation  $\Omega$  be given by  $\Omega = a + bw$ ,  $0 \leq a, b$ . The income independent part of unemployment benefits is defined by  $a$ , while the term  $bw$  captures the earnings-related element of unemployment compensation. In the terminology employed above, a Beveridgean system of social security is consistent with  $a > 0$  and  $b = 0$ , while a Bismarckian one entails  $b > 0$ . A value of  $a = 0$  implies a constant replacement ratio.

Summarising the evidence for 21 OECD countries, Table 1 indicates that in 1989 in 13 of these countries unemployment benefits were proportional to previous earnings, that is,  $a = 0$  applied.<sup>3</sup> A linear relationship entails  $b > 0$  and  $a \neq 0$ , and this was the case for 5 of the 21 countries. Australia, New Zealand and the United Kingdom had a flat-rate UI system. Moreover, in a number of countries there were ceilings on insurable wages which were often close to or even below the income of an average production worker, as defined by the OECD. For a person with an income which exceeds these ceilings, nominally proportional unemployment benefits are actually fixed. Moreover, guaranteed minimum incomes, which represent benefits for people who, for example, do not fulfil the qualifying conditions for UI payments, are mostly unrelated to previous earnings. Therefore, in 1989 a substantial number of OECD countries

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<sup>2</sup> Beveridge "defended the flat rate of benefit on the ground that graduation according to need would involve an undesirable inquisition into the private affairs of workmen; and graduation according to income was unnecessary, because highly paid workmen could obtain additional insurance ..." (Harris 1972, p. 308).

<sup>3</sup> Sweden is included in this number. However, although 12 different benefit levels existed in 1985, 97% of the recipients belonged to the highest benefit category (Schmid et al., 1992, p. 97). Thus, despite the nominally proportional UI system, implying  $a = 0$ , for Sweden  $b = 0$  might, instead, be a more appropriate assumption.

was characterised by flat-rate elements in their UI systems.<sup>4</sup> To illustrate the impact of the flat-rate component, in column 5 the differences in gross replacement rates for two workers with divergent income levels are depicted. A positive number indicates that replacement rates decrease with income, thus implying values of  $a > 0$  and  $b < 1$ .

Table 1: Relationship Between Earnings and Unemployment Compensation

Country	Type of Benefit a)	Level of Benefits	Ceiling on Insurable Wages as Proportion of Average Production Worker's Wage	Replacement Rate Differential b)
Australia	GI	fixed	not applicable	7
Austria	UI	linear	1.6	-
Belgium	UI	proportional	0.8	15
	GI	fixed	not applicable	
Canada	UI	proportional	1	1
	SW	fixed	not applicable	
Denmark	UI	proportional	0.8	15
	GI	fixed	not applicable	
Finland	UI	linear	no	8
France	UI	in general linear	5	13
Germany	UI	proportional	1.7	- 2
Greece	UI	proportional	0.7	-
Ireland	UI	linear or fixed	1.2	7
Italy	UI	proportional	0.7	- 1
Japan	UI	linear	0.9	8
Netherlands	UI	proportional	1.8	2
	GI	fixed	not applicable	
New Zealand	GI	fixed	not applicable	13
Norway	UI	proportional	1.2	2
	SW	fixed	not applicable	
Portugal	UI	proportional	2.6	-
	UA	fixed	not applicable	
Spain	UI	proportional	0.9	- 3
Sweden	UI	proportional	1.1	0
	UA	fixed	not applicable	
Switzerland	UI	proportional	1.7	2
United Kingdom	UI	fixed	not applicable	13
United States	UI	proportional	0.6 to 1.2	0

a) GI = Guaranteed Income, SW = Social Welfare, UA (UI) = Unemployment Assistance (Insurance)

b) The number represents the difference in 1995 gross replacement rates for the first month of unemployment for a married person with two children at two-thirds of the income of an average production worker (APW) and at the income of an APW. Data for Austria, Greece and Portugal not available.

Sources: OECD (1988, p. 120; 1991, pp. 228f, 1997, p. 29)

<sup>4</sup> It should be added that the features of UI systems depicted in Table 1 might have changed substantially over time. For example, in Austria the ceiling on insurable wages has dropped from 160% (1989) of an APW's income to about 55% (1995) (OECD 1998).

### 3. A Shirking Model

#### 3.1 Employees

Utility  $z^e$  of an employed worker can be depicted as  $z^e = v(w^n) - e$ , where  $e$  measures effort or the disutility which results from working. More specifically,  $e$  is the fraction of total working time during which effort is supplied. If working time is normalised to unity,  $e \in [0, 1]$  will hold and shirking will imply  $e < 1$ . The function  $v$  is strictly concave in income, and  $w^n = w(1 - T)$  is the worker's net wage. The parameter  $T$ ,  $0 \leq T < 1$ , measures the proportional income tax or the employee's contribution to a UI fund. An unemployed worker obtains (indirect) utility  $z^u = v(\Omega)$  because no effort is required when unemployed. Since the focus is on unemployment benefits, contributions to the UI are assumed not to reduce gross benefits  $\Omega$ , in line with the regulations in a majority of OECD countries (OECD 1994). The participation constraint requires  $z^e > z^u$ .<sup>5</sup> To simplify notation, subsequently  $v(w^n) \equiv v$  and  $v(\Omega) \equiv \tilde{v}$  will be used, while the respective arguments will be omitted.

Employees choose an optimal level of effort, given the wage. The relationship between effort and income defines the effort function which the company takes into account when maximising profits (see Pisaro (1991) for the basic model). Suppose that the probability of being caught shirking is  $p$ , which is a linear function of the time an employee has not exerted effort. For a parameter  $m$ ,  $0 < m < 1$ , capturing the exogenously determined effectiveness of monitoring, the detection probability  $p$  is given by  $p = m(1 - e)$ . Detection implies the immediate loss of the job. With a probability  $u$ ,  $u$  being the aggregate unemployment rate, the worker finds no new job and receives benefits  $\Omega$ . With probability  $(1 - u)$  s/he obtains another job in which the same wage is paid (see below). Thus, the average and the individual wage coincide in this economy.

Being caught shirking does not imply that the entitlement to unemployment compensation is lost. This reflects the notion that the eligibility rules might not require the (complete) withdrawal of benefits from shirkers<sup>6</sup> or that the agency paying out benefits cannot distinguish perfectly between those who lose their job for exogenous reasons and those who are fired because of insufficient effort - although the former possibility is not modelled here. Without complete experience rating of the firm's contributions to the UI, the company's incentives to prove that an employee was fired because s/he shirked can be limited. Hence, a positive probability exists that shirking and being fired will not be punished by a loss of benefits. Without affecting the results, this positive probability can be normalised to one. Only if the probability of obtaining unemployment benefits when caught shirking were equal to zero, would Atkinson's (1995, p. 197) statement hold, "that the existence of UI does not affect the incentive to shirk".

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<sup>5</sup> Thus, the mechanism which is inducing higher unemployment due to an earnings-related system in the model by Schluter (1997) does not apply in this model.

<sup>6</sup> See, for example, Capelli and Chauvin (1991, p. 777 FN), who report for the US that "(w)orkers dismissed for poor performance (shirking) are generally eligible for full benefits while even those dismissed for gross misconduct, such as felony convictions, lose only some of their eligibility." Winter-Ebmer (1998) reports likewise evidence for Austria.



Aggregate unemployment  $u$  is the difference between the size of the labour force, which is given and normalised to unity, and employment  $N$ , such that  $u = 1 - N$ . The unemployment rate also being given by  $u$ , expected utility  $E(U)$  of a currently employed worker is defined by:

$$(3.1) E(U) = (1-p)z^e + p((1-u)z^e + uz^u) = [1 - m(1-e)(1-N)](v-e) + m(1-e)u\tilde{v}$$

For simplicity, there is no discounting. Maximising expected utility  $E(U)$  with respect to  $e$  yields an effort function  $e = e(w, T, a, b, m, u)$ .

$$(3.2) e = 0.5 \left[ v(w^n) - \tilde{v}(\Omega) + 1 - \frac{1}{(1-N)m} \right]$$

An interior solution implies  $N < 1$ . Moreover, since a positive level of effort requires  $w^n > \Omega$ , owing to the assumption of  $0 < m < 1$ , the further analysis is based on the assumption of a net wage exceeding benefits. For later use, it is helpful to note that  $\partial e / \partial a \equiv e_a = e_\Omega = e_b / w = -\tilde{v}'/2 < 0$ , and that  $e_N < 0$ .

### 3.2 Firms

The economy consists of a large number  $\tau$ ,  $\tau \gg 1$ , of identical firms which pay efficiency wages to reduce shirking by its employees. Effort  $e$  and the number of employees per firm  $n$  are imperfect substitutes in the strictly concave production function  $f(f' > 0, f'' < 0)$ . The number of working hours is fixed. The firm has to pay a linear payroll tax  $s$ ,  $s > 0$ , incurs fixed costs  $h$ ,  $h > 0$ , and is a price taker in the output market. The existence of fixed costs allows for the assumption of finite positive profits without imposing restrictions on the production technology, such as the absence of constant returns to scale. Profits are thus given by:

$$(3.3) \Pi = f(en) - (1+s)wn - h$$

The company replaces employees who shirk, are caught doing so, and who are subsequently fired without delay and costs. The first-order conditions for a profit maximum are:

$$(3.4a) \Pi_w = f'ne_w - (1+s)n = 0$$

$$(3.4b) \Pi_n = f'e - (1+s)w = 0$$

From equation (3.4a) it becomes immediately obvious that marginal effort  $\partial e / \partial w = e_w$  is positive. Otherwise, the firm's maximisation problem will have no interior solution. Moreover, the second-order condition requires  $e_{ww} < 0$ . The firm's labour demand  $n$  decreases with  $w$  at the optimal wage and will increase with effort if  $(f''en + f') > 0$ .<sup>7</sup> This requirement on technology is assumed to hold. It will be warranted, inter alia, for a Cobb-Douglas-production function and also more generally if the elasticity of substitution between labour and another factor,

<sup>7</sup> The respective derivatives are given by:

$$\frac{dn}{dw} = \frac{\partial n}{\partial w} + \frac{\partial n}{\partial e} \frac{\partial e}{\partial w} = -\frac{f''ene_w + f'e_w - (1+s)}{f''e^2} = -\frac{e_w n}{e} < 0, \quad \frac{dn}{de} = -\frac{f''en + f'}{f''e^2}$$

which is fixed in this model, is sufficiently high (Pisauro 1991, fn15). The aggregate labour demand curve is denoted by  $\Phi$ , and aggregate employment  $N$  corresponds to the product of the number of firms  $\tau$  and employment per firm  $n$ .

$$(3.5) \Phi \equiv N - \tau n(w, e(w, T, \Omega, N), s) = 0$$

The combination of (3.4a) and (3.4b) yields the Solow-condition or shirking constraint  $\Psi$ .

$$(3.6) \Psi \equiv e_w(w, T, \Omega, b) \times w - e(w, T, \Omega, N, m) = 0$$

For later use note that the level of effort  $e$  is independent of the structure of unemployment compensation, while marginal effort  $e_w$  increases in the 'Bismarckian' factor  $b$ , for a given  $\Omega$ .

### 3.3 Equilibrium

To determine the impact of changes in the parameters of the UI system, it is helpful to depict the shirking constraint  $\Psi$  and the labour demand curve  $\Phi$  in the wage-employment space.

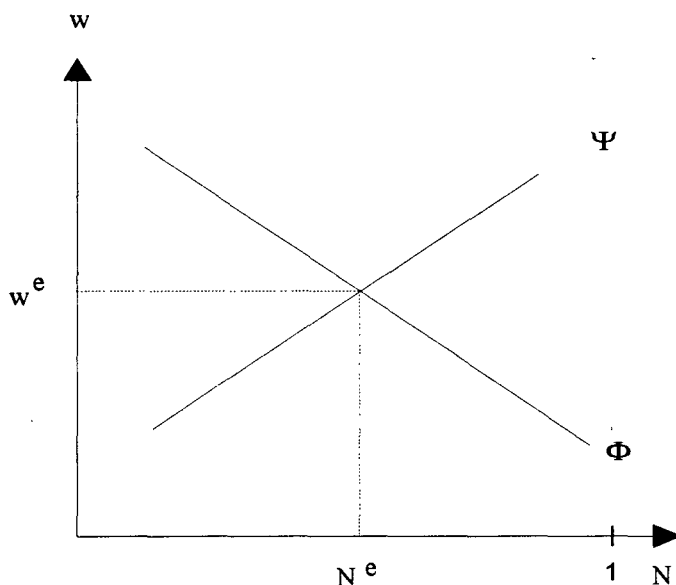
Note, therefore, that  $\Psi_w = e_{ww}w < 0$  and  $\Psi_N = -e_N > 0$ , while the derivatives of the labour demand schedule - evaluated at the firms' optimum - are given by:

$$(3.7) \Phi_w = \tau n e_w / e > 0, \text{ using (3.4a) and}$$

$$(3.8) \Phi_N = 1 + \frac{\tau(f''en + f')e_N}{f''e^2} > 0.$$

The intersection of the aggregate labour demand curve  $\Phi$  and the shirking constraint  $\Psi$  - which for purposes of simplicity are depicted as linear in Figure 1 - determines the efficiency wage  $w^e$  and the resulting level of (un-) employment.

Figure 1: Equilibrium in a Shirking Economy



#### 4. Reforming the UI System

In the short-run, changes in unemployment benefits might be possible without taking their budgetary implications into account. In Section 4.1, it will thus be investigated in what way the wage and employment outcomes depicted in Figure 1 will change if only the level or the structure of the UI system is varied. Should these variations also induce changes in the expenditure or in the revenues of the UI fund, adjustments are necessary in the longer-run. Since the focus is on an alteration of the structure of benefits, in Section 4.2, it will be analysed in how far the constraint of a constant expenditure per unemployed, that is, an ex-post constant unemployment compensation  $\Omega$ , affects the impact of a stronger earnings relationship of the UI system. In Section 4.3, the consequences of a cash limit on the expenditure of the UI system will be investigated. Then it is assumed that the UI is not only constrained with respect to its expenditure but faces a balanced budget requirement, that is, in Section 4.4, the revenue side is taken into consideration, as well. In Section 4.5, a very long-run perspective will be adopted by endogenising the number of firms and imposing a zero profit constraint on companies.

##### 4.1 Strengthening the Earnings Relationship Unemployment Compensation

From equation (3.6) and Figure 1 it can be seen that the shirking constraint will shift to the north-west in the wage-employment space if either of the parameters of the benefit system  $a$  or  $b$  increases. Higher benefits via an increase in  $a$  or  $b$  reduce effort for a given wage. Therefore, the aggregate employment level is only compatible with higher wages. A rise either in  $a$  or  $b$  thus implies higher wages and lower employment, along a given labour demand curve.

$$(4.1) \Psi_a = e_{wa}w - e_a = [\tilde{v}' - \tilde{v}''bw] / 2 > 0$$

$$(4.2) \Psi_b = e_{wb}w - e_b = -(\tilde{v}'w + \tilde{v}''w^2b - \tilde{v}'w) / 2 = -\tilde{v}''w^2b / 2 > 0$$

Moreover, the labour demand curve shifts to the south-west due to a rise in  $a$  or  $b$ , since effort falls. This reinforces the negative employment effect caused by the movement of the shirking constraint.

$$(4.3) \Phi_a = \Phi_b / w = \frac{\tau(f''en + f')}{f''e^2} e_a > 0$$

For an increase in the parameter  $a$ , the upward shift of the shirking constraint unambiguously dominates the downward movement of the labour demand schedule, since  $D$  is negative, where  $D = \Psi_w\Phi_N - \Phi_w\Psi_N < 0$ . Therefore, wages will rise. However, the wage consequences of a higher 'Bismarckian' factor  $b$  are ambiguous.

$$(4.4) \frac{dw}{da} = \frac{dw}{d\Omega} = \frac{\Phi_a\Psi_N - \Psi_a\Phi_N}{D} = \frac{\tilde{v}''bw}{2D} \left( 1 + \frac{\tau(f''en + f')}{f''e^2} e_N \right) - \frac{\tilde{v}'}{2D} > 0$$

$$(4.5) \frac{dw}{db} = \frac{\tau(f''en + f')we_N(\tilde{v}' + \tilde{v}''wb) + \tilde{v}''w^2bf''e^2}{2f''e^2D}$$

These potentially different wage effects occur because variations in  $a$  solely have a level effect. A rise in  $b$ , however, has a level effect as  $\Omega$  increases, but also raises the marginal gain from a higher alternative income. Therefore, increasing  $b$  represents not only an alteration of the structure of unemployment compensation, but also of its level.

To isolate the effects which result from a change in the structure of unemployment benefits, let an increase in  $b$  entail a reduction in  $a$ , such that  $\Omega$  does not change at the initial wage. Hence, the income effect is eliminated. This implies  $da = -wdb$ ,  $de/db = 0$ ,  $\tilde{v}'' = 0$ , and  $\Psi_b$  in equation (4.2) collapses to:

$$(4.6) \Psi_b|_{da=-wdb} = -\tilde{v}' w / 2 < 0$$

Labour demand  $\Phi$  is unaffected by a variation in  $b$ , because  $\Phi$  only depends on the level of effort. Thus, wage and employment consequences of a more Bismarckian social security system, holding the level of unemployment benefits constant at the initial wage, are solely governed by the shirking constraint's movement to the south-east in Figure 1. A stronger dependence of benefits on the current wage therefore reduces wages and unemployment.

The economic intuition for this result is straightforward: An increase in  $b$ , holding  $\Omega$  constant and thus reducing  $a$ , makes a given wage less attractive to the firm because marginal effort decreases with  $b$ . The shirking constraint attains a negative value, and as  $\Psi_w < 0$ , the wage has to be reduced. If unemployment benefits are earnings-related, the firm will effectively have to pay twice for higher wages: first, there is the direct wage effect and, second, there is the effort reducing impact via unemployment benefits. The firm's gain from a higher wage is given by the additional productivity. If  $b$  rises, while  $\Omega$  is held constant, the direct wage effect and the direct productivity effect will not change for a given wage, but the effort reducing impact becomes more pronounced. Hence, the disadvantageous consequences of higher wages outweigh the beneficial ones and the firm lowers the wage. As this reasoning applies to all firms and since the employment effect is solely governed by the wage reduction, unemployment falls. However, a reduction in wages entails lower unemployment benefits since the latter depend positively on the wage level. Effectively, a restructuring of unemployment benefits in such a way as to increase the earnings-related component  $b$  and to reduce the flat-rate element  $a$ , holding the level of benefits  $\Omega$  constant at the initial wage, that is, holding  $\Omega$  constant ex-ante, is tantamount to an ex-post reduction of unemployment compensation.

#### 4.2. Constant Ex-Post Unemployment Benefits

In this section, it will be investigated if the positive employment impact of a stronger earnings relationship can be sustained in the longer-run when an increase in the earnings-related element  $b$  is compensated by a change in the flat-rate component  $a$ , such that the level of benefits  $\Omega$  is constant, taking the change in wages into account. Holding the level of benefits  $\Omega$  ex-post constant can also be understood as the imposition of a budget constraint, since the expenditure per unemployed person remains unaltered. The endogenous variables of the system are the wage

$w$ , aggregate employment  $N$  and the flat-rate component of benefits  $a$ , while  $b$  is determined exogenously. Totally differentiating equations (3.5), (3.6) and  $\Omega - a - bw = 0$  yields:

$$(4.7) \begin{bmatrix} e_{ww}w & -e_N & e_{wa}w - e_a \\ \frac{\tau f'' e n e_w}{f'' e^2} & 1 + \frac{\tau(f'' e n + f') e_N}{f'' e^2} & \frac{\tau(f'' e n + f') e_a}{f'' e^2} \\ -b & 0 & -1 \end{bmatrix} \begin{bmatrix} dw \\ dN \\ da \end{bmatrix} = \begin{bmatrix} -(e_{wb}w - e_b) \\ -\frac{\tau(f'' e n + f') e_b}{f'' e^2} \\ w \end{bmatrix} [db]$$

The determinant of the system is given by  $D_c > 0$ , where  $e_{ww}$  has been substituted and use has been made of equation (4.1).

$$(4.8) D_c = [(e_{wa}w - e_a)b - e_{ww}w] \left( 1 + \frac{\tau(f'' e n + f') e_N}{f'' e^2} \right) - e_N \frac{\tau(f'' e n v'(1-T) + f' \tilde{v}' b)}{2f'' e^2} \\ = b \frac{\tilde{v}' - \tilde{v}'' b w}{2} - \frac{\tau e_N n e_w}{2e} - e_{ww}w - \frac{\tau(f'' e n + f') e_N (2e_{ww}w + \tilde{v}'' b^2 w)}{2f'' e^2} > 0$$

A change in the structure of the UI system so that a rise in the parameter  $b$  is compensated by a variation of  $a$  in such a way as to keep the overall level of benefits  $\Omega$  the same, is denoted by  $d\Omega = 0$ . The change in employment, owing to such a reform of the benefit system, is then given by, where  $e_a = e_b/w$  as well as equations (4.1) and (4.2) have been used:

$$(4.9) \frac{dN}{db} \Big|_{d\Omega=0} = \frac{\tilde{v}' \tau w \Theta}{4D_c f'' e^2} > 0, \text{ for } \Theta \equiv f'' e n v'(1-T) + f' \tilde{v}' b < 0.$$

For  $\Theta < 0$ , a stronger earnings relationship of unemployment benefits will not only increase employment if the level of benefits is held constant ex-ante, but will have the same qualitative impact for an ex-post constant level of benefits. This sign restriction on  $\Theta$  implies that either the production function is sufficiently concave, i.e. that  $(-f'')$  is large relative to  $f'$ , or that marginal effort  $e_w$  is sufficiently positive.<sup>8</sup> Irrespective of the sign of  $\Theta$ , the wage falls.

$$(4.10) \frac{dw}{db} \Big|_{d\Omega=0} = -\frac{\tilde{v}' w}{2D_c} \left[ 1 + \frac{\tau(f'' e n + f') e_N}{f'' e^2} \right] < 0$$

In comparison to Section 4.1, in which the level of benefits was held constant at the initial wage, the additional requirement of  $\Theta < 0$  for a positive employment impact also in the case of

<sup>8</sup> However,  $\Theta < 0$  is not a necessary requirement for a positive employment impact of a rise in  $b$  since the determinant of the system might also be written as:

$$D_c = [\Psi_a b - e_{ww}w] \left( 1 + \frac{\tau(f'' e n + f') e_N}{f'' e^2} \right) - \frac{e_N \tau \Theta}{2f'' e^2}. \text{ Thus, the change in employment can be depicted as:}$$

$$\frac{dN}{db} \Big|_{d\Omega=0} = \frac{0.5 \tilde{v}' \tau w}{(\Psi_a b - e_{ww}w) 2\Theta^{-1} (f'' e^2 + \tau(f'' e n + f') e_N) - e_N \tau}$$

A positive sign for this derivative thus requires  $\Theta < 0$  only as a sufficiency requirement.

an ex-post constraint can intuitively best be explained with the help of Figure 1. The rise in  $b$ , while holding  $\Omega$  constant, shifts the shirking-constraint to the south-east. Employment rises and wages unambiguously decline. Therefore,  $\Omega$  falls. Holding the level of benefits  $\Omega$  constant despite the fall in wages implies that the parameter  $a$  has to be increased further. This change, which does not occur for the case of  $\Omega$  being held constant at the initial wage, shifts the shirking constraint partly back. Moreover, a fall in the wage and a constant level of benefits  $\Omega$  reduces effort for a given level of employment. Thus, the aggregate labour demand curve shifts to the south-west and reduces employment. If this shift is sufficient to counteract the initially positive employment change, will depend on the slope of the aggregate labour demand curve and the shirking constraint. Holding the level of unemployment compensation ex-post constant can thus invalidate the beneficial employment impact of a stronger relationship between earnings and unemployment benefits.

#### 4.3 Cash Limits

A financial constraint which is often encountered by public entities is a cash limit (Leslie 1985, Holmlund 1997). Governments might therefore not be constrained by the level of benefits per unemployed, as argued above, but by the total expenditure of the UI system. This implies that, irrespective of the level of unemployment, the insurance system obtains a guaranteed amount of money. Such a constraint might be especially relevant for countries such as the UK, where there is no separate contribution to the UI system, or Belgium, where unemployment benefits are financed out of general taxation, or Germany, where no legal obligation exists to balance the budget even in the long-run (Atkinson and Micklewright 1991, Schmid et al. 1992, p. 89). Under a cash limit  $C$ , the equilibrium of the system is defined by equations (3.5) and (3.6) and by  $C - (a + bw)(1 - N) = 0$ . Totally differentiating these three equations with respect to the endogenous variables  $w$ ,  $N$  and  $a$  shows that the determinant of the system  $D_d$  is positive:

$$(4.11) \quad D_d = (1 - N)D_c + \frac{(e_w a w - e_a) f'' e n e_w - e_w w \tau (f'' e n + f') e_a}{f'' e^2} \tau \Omega > D_c > 0$$

The change in employment owing to a rise in the parameter  $b$  and a variation in  $a$ , while holding constant total outlays  $C$  of the UI system, which will be indicated by  $dC = 0$ , is given by:

$$(4.12) \quad \frac{dN}{db} \Big|_{dC=0} = \frac{\tilde{v}' \tau (1 - N) w \Theta}{4 D_d f'' e^2} > 0, \text{ for } \Theta < 0$$

A rise in the parameter  $b$ , holding the amount of cash spent on unemployment compensation constant will raise the number of employed, for  $\Theta < 0$ . This requirement is the same as in the case of constant ex-post benefits  $\Omega$ . Assume that employment rises due to the alteration in the structure of unemployment compensation, which is warranted for  $\Theta < 0$  (cf. (4.9)). If fewer people obtain the same benefits per person, total expenditure will shrink. Thus, unemployment compensation has to increase in order to warrant the constraint of a cash limit. However, the higher level of benefits will not invalidate the positive employment impact of the reform of the

UI system since the rise in  $\Omega$  is conditional upon the fall in unemployment. If, in contrast to the above hypothesis, the level of employment will fall owing to a rise in  $b$ , constant benefits imply a higher expenditure of the benefit system. In order to reduce outlays, the level of benefits has to be reduced and the fall in employment is mitigated. Once again, the countervailing effect is conditional on the initial change in employment. A cash limit which imposes constant outlays, having taken the changes in employment and wages into account, is therefore analytically similar to the imposition of an ex-post constant level of benefits. Since an ex-post constant level of benefits does not ensure a positive employment impact of restructuring the UI system, the same is true for a system characterised by a cash limit.

#### 4.4 Balanced Budget

A complete analysis of the employment impact of changes in the structure of unemployment compensation requires an investigation, not only for constraints involving the expenditure of the UI system, but also including revenues since, in the long-run, governments might not be able to sustain changes in the benefit system simply because they do not affect the outlays of the UI system. Therefore, contributions to the UI have to be taken into account. Suppose for this purpose that  $s$  and  $T$  represent the payments to the UI fund by employers and employees, or that payroll taxes  $s$  and income taxes  $T$  are earmarked for the UI. Moreover, the UI system has no other revenues. A rise in the payroll tax  $s$  does not affect the shirking constraint for a given level of employment while it shifts the labour demand curve to the south-west in the wage-employment space. Thus, wages and employment will fall if the payroll tax is raised. An increase in the income tax  $T$  will also reduce employment, as long as the alternative income is untaxed.<sup>9</sup> Assuming a positive employment impact of restructuring unemployment benefits in the absence of a budget constraint, a sufficient condition for a balanced budget requirement not to invalidate this result is, therefore, that contributions need not rise. Thus, the impact of an increase in the parameter  $b$  on the budget of the UI fund has to be investigated.

The revenues of the UI fund are given by the 'income' tax payments  $wT$  by  $N$  employees, plus the 'payroll' tax  $swN$ . Its outlays consist of unemployment benefits  $\Omega$  for  $(1 - N)$  people. In the absence of administrative costs, the balanced budget requirement  $B$  can thus be written as:

$$(4.13) \quad B \equiv Nw(T + s) - (1 - N)\Omega = w(N(T + s) - (1 - N)b) - (1 - N)a = 0$$

In contrast to the case of fixed benefits or the imposition of a cash limit, in which a rise of one element  $a$  or  $b$  of unemployment compensation automatically entails a change in the other ele-

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<sup>9</sup> Note that  $\Psi_s = 0$  and  $\Phi_s = -\tau w / f'' e^2 < 0$ . The result that higher unemployment benefits and higher contributions to the UI fund reinforce each other in their adverse employment consequences concurs with the prediction by, for example, Shapiro and Stiglitz (1984) since higher payroll taxes on their own reduce employment (Pisauro 1991, Schmidt-Sørensen 1991). A rise in the parameter  $T$  shifts the Solow-condition to the north-west and the labour demand curve to the south-west in the wage-employment space since  $\Psi_w < 0$  and  $\Phi_w > 0$ , while  $\Psi_T = -v''(1 - T)w / 2 > 0$  and  $\Phi_T = -\tau(f''en + f')v'w / 2f''e^2 > 0$ . Both shifts imply a lower level of employment.

ment as well, this is not necessarily the case for a balanced budget since contributions might also be amended. Hence, it will first be investigated under what conditions a rise in either of the parameters  $a$  or  $b$  of the benefit system requires higher contributions to the UI fund. Subsequently, the budgetary effects of a stronger earnings relationship of benefits will be studied.

A sufficient condition for a negative employment effect of a rise in  $x$ ,  $x = a, b$ , is  $dB/dx \leq 0$ , as an increase in  $x$  on its own already reduces employment (cf. Section 4.1). For given contributions  $s$  and  $T$ , labour demand  $N$  changes with a rise in  $x$ , first, since the wage increases and, second, because effort declines.  $dB/dx$  is therefore given by:

$$(4.14) \quad \frac{dB}{dx} = N_e e_x (w(T+s) + \Omega) + \frac{w_x (T+s)}{N} (\varepsilon + 1) + N_w w_x \Omega - (1-N) \Omega_x$$

A labour demand elasticity  $\varepsilon = N_w w/N \leq -1$  is a sufficient though not a necessary condition for  $dB/dx < 0$  to hold, as  $N_e, w_x, \Omega_x > 0$  and  $e_x, N_w < 0$ . Thus,  $\varepsilon \leq -1$  ensures that the long-run employment reduction owing to a rise in the parameters  $a$  or  $b$  will be greater if a balanced budget constraint is imposed in comparison to a situation without this restriction. If, however, the budgetary impact of a rise in unemployment benefits is positive - a case which cannot be ruled out since the increase in wages could raise revenues sufficiently - the long-run employment consequences of an increase in  $a$  and/or  $b$  will be less adverse than the short-run impact.

Turning to the analysis of a change in the structure of the UI system, that is, a rise in the 'Bismarckian' factor  $b$ , it has again to be taken into account that employment is a function of wages. Moreover, wages decline with a rise in  $b$  ( $w_b < 0$ ), irrespective of whether the wage change is calculated for ex-ante or an ex-post constant benefits (cf. equations (4.6) and (4.10)). For a constant level of benefits  $\Omega$  at the initial wage,  $\partial\Omega/\partial b = bw_b < 0$  holds. Replacing  $\Omega$  with the help of equation (4.13), the budgetary effect of a rise in  $b$  and a fall in  $a$  is then determined by:

$$(4.15) \quad \frac{dB}{db} \Big|_{da=-wdb} = w_b (T+s) \left[ \frac{(1-u)(\varepsilon+u)}{u} - b \left\{ \frac{u}{T+s} - \frac{N_e e_\Omega w}{u} \right\} \right]$$

Since  $e_\Omega < 0$  and  $N_e > 0$  if  $(f''_{en} + f') > 0$  holds, as it has been assumed above (cf. equations (3.2) and (3.4b)), a sufficient condition for the budget effect to be positive, given an ex-ante constant level of benefits, is that  $\varepsilon + u < 0$ . If, instead, the parameter  $a$  is adjusted in such a way as to keep the level of benefits  $\Omega$  constant after the wage change has been taken into account, the budgetary impact will be given by equation (4.15), where the expression in curly brackets is zero. Hence,  $\varepsilon + u < 0$  becomes a necessary condition for  $dB/db > 0$ . Labour demand elasticities in general seem to be less than unity, but easily exceed 0.15 in absolute value, such that Hamermesh (1993, p. 135) concludes that 0.3 is "a good 'best guess' " for a labour demand elasticity.<sup>10</sup> Unless labour demand elasticities are unusually low or unemploy-

<sup>10</sup> Hamermesh's conclusion is based on constant output estimates; elasticities calculated on the basis of variable output tend to be even higher. Since the capital stock is held fixed in this model,  $\varepsilon$  is thus a 'capital constant' elasticity and - strictly speaking - not directly comparable to Hamermesh's best guess.



ment rates are extremely high, the imposition of a balanced budget constraint does not invalidate the consequences of an increase in the earnings-related share of unemployment compensation, irrespective of whether the level of benefits is held constant for a given wage, or having taken the wage change into account. The condition for a budget surplus assuming an ex-post constant level of benefits is more restrictive than under the assumption of an ex-ante constant level of benefits since the ex-ante variant implies a reduction in benefits owing to the lower wage. Thus, outlays of the UI fund will eventually fall and contributions can be lowered. This reduction in  $s$  or  $T$  reinforces the increase in employment.

In the short-run, strengthening the earnings relationship of unemployment benefits at the expense of a wage-independent element raises the level of employment in an efficiency wage world in which employees shirk. In the medium-run, the level of unemployment benefits might be adjusted to the change in wages either because unemployment compensation is held constant ex-post or because the expenditure of the UI fund is given. Such constraints induce a stronger incentive to shirk such that the positive employment effect can vanish. In the long-run, when the difference between revenues and expenditure of the UI fund has to be constant, the (positive) employment impact of a stronger earnings relationship will not be altered, given plausible values for unemployment rates and labour demand elasticities.

#### 4.5 Zero Profit Constraint

Thus far, various versions of budget constraints have been interpreted as an indication of a longer term perspective. It could, however, also be argued along the lines of Albrecht and Vroman (1996) and Rasmussen (1998) that an appropriate way of introducing a long-run perspective into efficiency wage frameworks is the assumption of a variable number of firms and the imposition of a zero (or constant) profit constraint. Any positive (negative) level of profits will induce firms to enter (leave) the market until a zero profit equilibrium is restored.

Throughout the previous analysis, firms have been identical. However, it can also be assumed that fixed costs  $h$  vary across firms. Their level will then determine which firms will leave (enter) the market if profits fall (rise) but will not affect the first-order conditions (cf. equations (3.3) and (3.4)).

The equilibrium of an economy in which (marginal) firms are characterised by zero profits is defined by the shirking constraint (3.6), the aggregate labour demand curve (3.5) with a variable number of firms  $\tau$ , and the zero profit constraint for given output prices (cf. (3.3)). The endogenous variables are the wage  $w$ , aggregate employment  $N$ , and the number of firms  $\tau$ , while variations in the parameter  $x$  of the benefit system,  $x = a, b$ , and in the 'Bismarckian' factor  $b$ , holding  $\Omega$  constant at the initial wage, are treated as exogenous.

$$(4.16) \begin{bmatrix} e_{ww}w & -e_N & 0 \\ \frac{\tau n e_w}{e} & 1 + \frac{\tau(f''en + f')e_N}{f''e^2} & -n \\ 0 & f'ne_N & 0 \end{bmatrix} \begin{bmatrix} dw \\ dN \\ d\tau \end{bmatrix} = \begin{bmatrix} -(e_{wx}w - e_x) & \frac{\tilde{v}'w}{2} \\ -\frac{\tau(f''en + f')e_x}{f''e^2} & 0 \\ -f'ne_x & 0 \end{bmatrix} \begin{bmatrix} dx \\ db \\ \left. \frac{da}{db} = -w \right\} \end{bmatrix}$$

In the short-run, i.e. without the zero profit constraint, the 2 x 2 matrix in the left hand corner defines the effects of variations in the parameters of the UI system, for a given number  $\tau$  of firms. These short-run effects are denoted by the subscript  $s$ , while the long-run impact which can be obtained when imposing the constant profit restriction is indicated by the subscript  $l$ .

$$(4.17) \left. \frac{dN}{dx} \right|_l = -\frac{e_x}{e_N} < 0$$

$$(4.18) \left. \frac{dN}{dx} \right|_s = -\frac{e_x(e_{ww}wn_e + n_w) - \varepsilon e_{wx}n}{e_N(e_{ww}wn_e + n_w) - e_{ww}\frac{w}{\tau}} < 0$$

In the long-run, the adverse employment effects of a rise in unemployment benefits, that is, in  $a$  or  $b$ , can therefore either be stronger or weaker than in the short-run, depending on the magnitude of the labour demand elasticity  $\varepsilon = N_{ww}w/N$  and the sign of  $e_{wx}$ . This result does not give support to the prediction by Albrecht and Vroman (1996). Based on a shirking model with dichotomous effort and flat-rate benefits the authors show that the adverse employment effects model of a rise in unemployment compensation are stronger in the long- than in the short run. However, in a framework with a continuous effort function and earnings-related unemployment benefits, the incentives to raise wages are reduced, owing to the benefit effect. If the impact on profits is substantial - which depends on the curvature of the effort function relative to the elasticity of labour demand -, the number of firms might rise such that aggregate employment can decrease by less in the long- than in the short-run.

Turning to variations solely in the parameter  $b$ , while  $\Omega$  is held constant at the initial wage such that  $da = -wdb$  applies, from equation (4.16), the subsequent results can be obtained:

$$(4.19) \left. \frac{dw}{db} \right|_{l, da=-wdb} = \frac{\tilde{v}'}{2e_{ww}} < 0$$

$$(4.20) \left. \frac{dN}{db} \right|_{l, da=-wdb} = 0$$

$$(4.21) \left. \frac{d\tau}{db} \right|_{l, da=-wdb} = \frac{\tilde{v}'\tau e_w}{2e_{ww}e} < 0$$

In the long-run, raising  $b$  while lowering the parameter  $a$ , such that the level of unemployment benefits  $\Omega$  does not change at the initial wage, reduces wages and the number of firms and has no employment effects. For a given level of aggregate employment  $N$ , the reduction in wages induces lower effort and higher employment per firm. Moreover, the effects of changes in  $w$  and  $n(w, e)$  on profits cancel out. But if all firms employ more people, aggregate employment

will rise - in contrast to the above assumption -, and effort will be reduced. Hence, companies will experience losses and some of them will stop production. The number of firms  $\tau$  shrinks, unemployment rises again such that effort increases, and the initial profit level is restored. The overall employment effect is zero.

Suppose that, in addition to the zero profit constraint, the level of benefits  $\Omega$  is held constant ex-post. Thus, the parameter  $\alpha$  of the UI system has to be raised by more than required for ex-ante constant unemployment benefits  $\Omega$ . Since an increase in unemployment compensation unambiguously reduces employment, the imposition of a zero (constant) profit constraint combined with an ex-post constant level of benefits implies a negative employment effect of a stronger earnings relationship of the UI system.

## 5. Policy Implications

It has been shown that the structure of unemployment benefits will affect the level of employment in an efficiency wage world. Strengthening the dependence of benefits on earnings will reduce unemployment in a shirking framework if unemployment benefits are held constant for a given wage. In this sense, a Bismarckian UI system has less adverse employment effects than a Beveridgean scheme. Holding the level of unemployment benefits constant after wage changes have been taken into account might reverse the positive employment consequences of a stronger earnings relationship of unemployment compensation. The same prediction can be obtained if the expenditure of the benefit system is restricted. If the UI system is constrained by a balanced budget requirement, strengthening the earnings relationship of unemployment benefits will raise employment for constant ex-ante benefits and will increase the likelihood of a positive employment impact for an ex-post constant unemployment compensation, assuming plausible values for the unemployment rate and the labour demand elasticity. Finally, in the very long-run when firms are constrained to a constant level of profits, the structure of unemployment compensation has no impact on unemployment for a given level of benefits at the initial wage, since the profit requirement invalidates all changes in the level of employment. These results are summed up in Table 2.

Table 2: Employment Effects of a Stronger Earnings Relationship of the UI System

Ex-ante Constant $\Omega$	Ex-post Constant $\Omega$	Cash Limit	Balanced Budget		Constant Profits	
			Ex-ante Constant $\Omega$	Ex-post Constant $\Omega$	Ex-ante Constant $\Omega$	Ex-post Constant $\Omega$
+	+	+	+	+	0	-
	if $\Theta < 0$	if $\Theta < 0$	if $\varepsilon + u \leq 0$	if $\Theta \leq 0$ and $\varepsilon + u < 0$		

Conditions represent sufficiency requirements,  $\Theta \equiv f'' \text{env}'(1-T) + f' \tilde{v}' b$  and  $\varepsilon = N_{ww}/N$

A number of theoretical aspects seem to be of importance in order to assess in how far policy advice can be based on the hypothesis that a Bismarckian UI will be superior to a Beveridgean one in terms of its employment outcomes if benefits are allowed to adjust to changes in wages.

First, a stronger dependence on earnings while holding the level of UI benefits constant at the initial wage is akin to a higher marginal income tax, which has also been shown to raise employment in efficiency wage frameworks (Goerke 1997a, Hoel 1990) or trade union models with exogenous or endogenous membership (Lockwood and Manning 1993, Goerke 1997b). In contrast to higher marginal tax rates, which distort labour supply decisions, it can be argued that comparable alterations of UI compensation will not have such adverse effects.<sup>11</sup>

Second, the employment superiority of a Bismarckian system might be a feature which is specific to the shirking model of efficiency wages analysed here. If effort is independent of the alternative income and the effort function can be depicted by  $e = e(w)$ , the level and structure of unemployment benefits will play no role. Moreover, if effort is a dichotomous variable, marginal effort will not be affected by a rise in  $b$  (see, for example, Atkinson (1995) or Pissarides (1998)). A more Bismarckian system would not expand employment, but cause no harm either.

Third, real world UI systems are often characterised by minimum benefits, ceilings, step-wise increases of payments - such that there is only an approximate proportionality between earnings and benefits - by the existence of means-testing and by a host of other special regulations. These features could imply that a stronger earnings relationship of benefits - holding the level of benefits constant - is easier to achieve in theory than in practice.

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<sup>11</sup> See Holmlund and Lundborg (1996) for a similar argument with respect to UI premiums - instead of benefits - in the context of a trade union model with endogenous membership.

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